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ON THE GENUS CITULA

The genus Citula (Cuvier) contains Carangin species (fishes of the sub-family Caranginae) of undoubted close relationship to Caranx and Carangoides, generally more compressed, approaching somewhat the distorted form seen in Alectis, Selene and Vomer, differing from those species of Carangoides which have naked breasts, in the filamentous lobes of vertical fins. It will be remembered that the large genera Caranx and Carangoides are separated on dentition, which is villiform in the latter. Our American Citula *(dorsalis)* has thoroughly villiform dentition and is assuredly nothing more nor less than a specialized Carangoides. The type of the genus Citula *(armata),* however, has an outer series of somewhat enlarged teeth in the premaxillaries, and perhaps closer relationship with Caranx. It would be a reasonable view-point to consider *armata* and *dorsalis* parallel specializations of Caranx and Carangoides respectively, not related more closely. This would break up the genus Citula and make it not worth while to recognize same, its recognition being more or less a matter of convenience anyway; the species are so close to Caranx or Carangoides. Some of the species of Citula (as recognized) would then fall with Caranx, some with Carangoides and we would have to draw the line separating those two genera between the more specialized as well as the less specialized forms (which would enhance the diffi-

culty of drawing such a line), or lump them all together.

Another view-point is, however, reasonable; namely, that the numerous less specialized members of the group (in body and fin form) have developed differences in dentition separating them into two genera, Caranx and Carangoides, whereas in the few more specialized ones such differences are less marked and may be given less weight. Probably the actual facts of relationship are complicated and accord exactly with neither view-point. Such being the case, it is the second which is here adopted and Carangin fishes with body compressed, but not extremely so, scales lacking on breast, present on remainder of body, scutes reduced, but present and distinct, teeth usually villiform, lobes of one or both vertical fins filamentous terminally, or extending to peduncle or beyond, and frequently other rays of such fins produced in isolated filaments, are grouped in the genus Citula. From a broad evolutionary view-point the genus so characterized is a unit, all its species with so nearly the same inheritance that the probability that a single one will split into divergent lines of development is about as good as that differences already existant will persist and be magnified. To some extent our treatment is open to the criticism of favoring the heresy of multiple origin. As a matter of fact, though accepting the principle of unit origin as sound, and to be well-established as any evolutionary law, we doubt if the facts, if known, would bear it out in every minutest detail.

In the genus Citula as so defined we may place the following species:— *Sciaena* [*Citula*] *armata* Forskal, East coast of Africa and the Red Sea to Japan, Australia and New Guinea; *Carangoides altissimus* [*Citula altissima*] Jordan and Seale (Philippines) Philippines and Australia; *Caranx oblongus* [*Citula oblonga*], C. & V., India to Polynesia; *Citula plumbea,* Q. & G. (Isle de France), Isle de France to Samoa; *Caranx* [*Citula*] *mandibularis* Macleay, New

Guinea; *Carangoides* [*Citula*] *chrysophryoides* Bleeker, Sea of Batavia; *Carangoides* [*Citula*] *dinema,* Bleeker, Sea of Batavia; *Carangoides* [*Citula*] *dorsalis,* Gill, Pacific coast of Mexico, Mazatlan to Panama; *Carangoides* [*Citula*] *ophthalmotaenia,* Bleeker, Amboyna. On the other hand, *Caraux* [*Carangoides*] *humerosus* McCulloch, *Caranx* [*Carangoides*] *gilberti* Jordan and Seale and *Caranx* [*Carangoides*] *deani* Jordan and Seale, with other species in which the vertical fins, though elevated do not reach to the peduncle, should go in Carangoides. *Citula halli,* Evermann and Seale, does not belong here, and probably not in the sub-family Caranginae.

Other compressed Carangins with filamentous fins undergo considerable age changes wherein the adult is less specialized, more Caranx-like than the young. The American Museum collections contain two specimens of *Citula dorsalis* from the Gulf of California, 80 and 480 mm. to base of caudal, respectively, a comparison of which will given an idea of such changes in that fish. The smaller specimen is deeper (1.6 *versus* 2.1); the keel on top of head more pronounced, extending further back; more compressed (breadth in depth 4.2 *v.* 3.2). Its filamentous dorsal lobe is broken, that of the anal less abruptly filiform and longer, at least to beyond the end of caudal instead of slightly beyond base of same (from anal origin 2.1 *v.* 1.3 times head). The pectoral is less falciform, reaching to the angle of the lateral line instead of well beyond that point (1.0 *v.* 1.3 times head.) The spinous dorsal is well developed in this small individual, whereas in the large one only traces of it remain; the arch of the lateral line about equals straight part in both cases. In the small specimen the head is about the same (3.1 *v.* 3.0 in length), eye larger (3.2½ *versus* 4.7 in head), ventrals longer (1.7 *v.* 3.1 in head). The lower jaw which projects slightly in the small individual is slightly included in the larger, and as is to be expected, the villiform teeth form a compara-

tively narrower band in the smaller (its breadth about 52 *v.* about 34 in head).

It will be seen from the above that the changes with age in *Citula dorsalis* are comparable with those in more specialized Alectis, etc., wherein the young are more extreme than the adult. The statement by Jordan and Evermann (1896, U. S. Nat. Mus., Bull. 47, 1, 929-930) concerning Citula (and apparently speaking of *C. dorsalis*):—"The young is more like *Caranx* in form and appearance than the adult, its later development carrying the fish farther in the direction of the extreme forms *Alectis, Hynnis* and *Selene*,"—should have been reversed.

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MR. BOULENGER ON THE GENUS *BABINA*.

In an article entitled *"Sur la conformation des phalangettes chez certaines Grenouilles d'afrique,"* published in *Comptes rendus des seances de l'Academie des Sciences,* Vol. 165, pp. 987-990, in 1918, Mr. Boulenger expresses certain opinions regarding *Babina* a genus proposed by me, in 1912, for two species of Dagger-Frogs, *Rana holsti* and *Rana subaspera,* from the Loo Choo Islands. Mr. Boulenger states that *Babina* is based upon a secondary sexual character which will not justify even subgeneric separation from the genus *Rana.* He continues:

"Ce genre *Babina* est fonde sur un caractere sexuel secondaire, le male etant pourvu d'une epine osseuse au pouce (l'extremite du premier metacarpien), percant la peau, epine dont la fonction est assurement la meme que celle des aiguillons cornes et caducs qui arment le doigt interne de certains *Leptodactylus* d'Amerique et qui servent a renforcer l'amplexus pendant l'accouplement, au point qu'on se demande comment la femelle ne succombe pas aux blessures d'une parielle etreinte. Cette epine au pouce de la "grenouille a

poignards," comme la nomme Van Denburgh, qui ne saurait a elle seule justifier le genre *Babina.*"

In describing Babina (Proc. Cal. Acad. Sci., Ser. 4, Vol. III, p. 196) I stated: "What at first sight appears to be an innocent rudiment of a thumb is in reality a most formidable weapon.

"Mounted upon the inner side of the carpus is a long, curved, sharply pointed bone, which seemingly is the first metacarpal. It is about equal in length to the other metacarpals. This bony spur is completely covered by the soft tissues about it. When, however, pressure is made upon the end of the 'thumb,' this sheath of soft tissue slips back and leaves the bony weapon exposed and ready for use. When one of these frogs is caught, it strives to grasp a finger between its two hands, and when it succeeds,—as the first one did—the spurs are driven into the finger down to the bone. Several specimens of *Rana namiyei* were badly slashed by some *B. holsti* that were put into the same bag. One received a clean-cut wound forty-five millimeters long in addition to several minor injuries. One can have only feelings of pity for any snake which might succeed in swallowing one of these dagger-frogs.

"Both of these frogs have an unusual aggregation of glands above the insertion of the arm. It is probable that the secretion of these glands might often run down into wounds made by the spurs."

Regarding these statements Mr. Boulenger remarks:

"Van Denburgh parle des eperons de *Rana holsti* comme d'une arme defensive. L'explication de ces faits mal interpretes est tres simple: a defaut de femelles, les males, dans la frenesie du rut, se cramponnent a toutes sortes d'animaux, ou meme d'objects, tels qu'un baton qu'on leur tend, ainsi que, parmi les Anoures d'Europe, notre crapaud commun nous permet de le constater tous les ans au printemps."

In order to show that Mr. Boulenger's opinions regarding *Babina* are entirely untenable it is only necessary to state the fact that the "dagger" is fully developed in adult specimens of both sexes. Our collection includes females which contain eggs nearly ready for laying. These are armed with spurs as large and formidable as are to be found in males.

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A NOTE ON *BABINA*, THE DAGGER-FROG.

Some time ago the American Museum received from Nago, Okinawa Island, a large but sexually immature female specimen of *Babina holsti* (Boulenger). *Babina* was originally described by Thompson[1] who considered the presence of the "dagger" (a rudimentary thumb or prepollex[2]) as sufficient reason for separating *Rana holsti* Boulenger and *R. subaspera* Barbour from their congeners. Recently Boulenger[3] in referring *Babina* to the synonymy of *Rana* has stated that the "dagger" is only a secondary sexual character peculiar to the males. This statement must have been an oversight on Boulenger's part for his type specimen (Brit. Mus. 92. 9. 3. 19) of *R. holsti* is a female with well-developed dagger[4]. Further our immature female has a very distinct "dagger" and Dr. John Van Denburgh has informed me by letter that several of the specimens in the series reported upon by Thompson and later by himself[5] are adult with "daggers" as large as those of the males.

Other species of frogs besides those referred to *Babina* are capable of exposing the terminal phalanges

[1]Prodrome of a Description of a New Genus of Ranidae from the Loo Choo Islands. Herpetological Notes, No. 1, June 15, 1912, p. 2.

[2]The homologies of this bone have never been satisfactorily determined.

[3]C. R. Acad. Sci. Paris, CLXV, 1917, p. 989.

[4]Stejneger, Bull, U. S. Nat. Mus., No. 58, 1907, p. 105, fig. 84.

[5]See Barbour, Occ. Papers Mus. Zool., Univ. Mich., No. 44, 1917.

of one or more of the digits. Boulenger[1] has discussed these other forms in some detail but he does not make any suggestion as to the possible significance of this peculiarity. It is noteworthy that these so-called "claws" occur in only two groups of ranids. The first group comprises the three closely related genera *Astylosternus, Gampsosteonyx* and *Scotobleps. Astylosternus* and *Gampsosteonyx* grade into each other, while *Scotobleps* originally defined as a "*Rana* with a vertical pupil" might more properly be called an *Astylosternus* which has developed a bony deposit in its sternum. The peculiar divided omosternum of these three genera suggests specialization. It is not a primitive structure.

The second group of frogs having "claws" are all species of *Rana* grouped by Boulenger in the subgenus *Ptychadena* because of their peculiarly modified pectoral girdle and their claw-shaped phalanges which in most cases do not pierce the skin. I may now add another species to this group, *Rana christyi* Boulenger, a form in which the terminal phalanges are more commonly exposed than in *R. mascareniensis* Dumeril & Bibron, the type of Boulenger's *Ptychadena.*

At the present time it is only possible to conclude with Boulenger that these exposed phalanges have no special function (except possibly the "dagger" of *Babina).* It is well to emphasize, however, that the "claws" occur only in two natural groups which seem to be the end stages of two lines of specialization. Not always can a function be assigned to a specialization in the Salientia. The modification of the pectoral girdle, the development of bony casques or the loss of teeth[3] have been shown in a number of cases to be unaccompanied by any change of habits in the derived

[1]Idem pp. 987-990.

[2]Boulenger, Proc. Zool. Soc. London, II, 1900, p. 438, Pl. XXVIII, fig. 1.

[3]This last type of modification is discussed in another paper, Barbour & Noble, 1920, Bull. Mus. Comp. Zool., Cambridge, Mass., LXIII, p. 408.

form. It would be interesting to know definitely how far change of function has accompanied change of form in *Babina.*

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SALT-WATER MINNOW IN FRESH WATER.

On February 23, 1919, I caught with a dip-net, an immature Mummychog or Common Killifish *(Fundulus heteroclitus macrolepidotus)* in a ditch in the edge of a salt-marsh at Douglaston, on the north shore of Long Island. On the same day I placed it in a fresh-water aquarium in which were two or three small goldfish. It was fed the same food as the goldfish. To my great surprise it lived in fresh water for eleven months or until January 23, 1920, on which date it was found dead in the aquarium from some cause not evident to me. The specimen was carefully examined by J. T. Nichols, Associate Curator of Fishes in The American Museum of Natural History, and positively identified as indicated above.

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Edited by J. T. NICHOLS, American Museum of Natural History

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